

## Identification of peanuts and tree nuts: are allergists smarter than their patients?

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### ARTICLE INFO

#### Article history:

Received for publication March 31, 2013.

Received in revised form May 28, 2013.

Accepted for publication July 4, 2013.

### ABSTRACT

**Background:** It has been reported that peanut- or tree nut-allergic individuals and their guardians are poorly capable of differentiating various tree nuts and peanuts. No information exists on the ability of allergists to differentiate peanuts and tree nuts.

**Objective:** To measure the ability of allergists and other specialists within the allergy and immunology field to identify various types of tree nuts and peanuts.

**Methods:** A nut box with a clear cover was constructed and contained various tree nuts and peanuts in shelled and unshelled forms. Attendees at the 2012 national meeting of the American Academy of Allergy, Asthma, and Immunology were offered participation by viewing the nut box and filling in their responses to a questionnaire. A similar procedure was conducted in the Food Allergy Center at Children's Medical Center (Dallas, TX) for guardians of children with and without peanut or tree nut allergies.

**Results:** Allergists were better able to identify and differentiate tree nuts and peanuts than guardians of peanut- or tree nut-allergic children, guardians of children without food allergies, and allergy and immunology fellows in training.

**Conclusion:** It is important for allergists to educate peanut- and tree nut-allergic individuals and their guardians on the proper avoidance of peanuts and tree nuts. This includes education in the ability to identify peanuts and tree nuts. In addition, allergy and immunology fellows in training may benefit from education in proper peanut and tree nut identification.

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### Introduction

Avoidance is the cornerstone of treatment for food allergy,<sup>1</sup> and in patients with life-threatening food allergies, this is of paramount importance. Recent data have suggested the prevalence of food allergy is increasing,<sup>2</sup> and a striking increase in the prevalence of children with peanut or tree nut allergies<sup>3</sup> is particularly concerning given the severity of reactions reported to peanuts and tree nuts. In fact, peanut and tree nut allergies are the leading cause of death from food-induced anaphylaxis.<sup>4,5</sup> Investigators have found that peanut- or tree nut-allergic children are no better at identifying peanuts and tree nuts than children without peanut or tree nut allergies,<sup>6</sup> and other investigators have recently reported that adults and children with or without a peanut or tree nut allergy could not reliably identify peanuts or tree nuts.<sup>7</sup>

Education for allergen avoidance often begins in the physician's office. It is typically the role of the physician, nurse, or registered dietitian to educate the family in allergen identification and avoidance. Given the poor ability of adults to identify peanuts and

tree nuts, the authors sought to understand the ability of allergists to identify peanuts and tree nuts and to compare their aptitude with that of caregivers of children being seen at the Food Allergy Center at Children's Medical Center (Dallas, Texas).

### Methods

#### Nut Box Construction and Scoring System

A sealed and locked nut box was constructed, and samples of several common tree nuts and peanuts with and without shells were used. The box was covered with a clear plastic top for easy viewing and to prevent unintentional exposure to nuts. Included in the container were hazelnuts (filberts), shelled and unshelled peanuts, shelled and unshelled pistachios, Brazil nuts, cashews, almonds, walnuts, macadamia nuts, pecans, slivered almonds, sliced almonds, and pine nuts (Fig 1). Subjects were asked to identify each nut by writing the likely nut in a blank on a piece of paper corresponding to the labeled compartment on the nut box. The total score was measured by the total number of tree nuts and peanuts correctly identified, with a maximum score of 14.

#### Subjects at the Food Allergy Center

From August 2010 through December 2010, guardians of pediatric patients at the Food Allergy Center were recruited to participate

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**Disclosures:** Dr. Bird has served on the Speaker's Bureau for Nutricia. The other authors have nothing to disclose.

**Funding Source:** No external funding was secured for this study.





**Figure 1.** Nut box used in the experiment. (A) Hazelnut (filbert). (B) Pistachios without shell. (C) Peanuts out of the shell. (D) Brazil nuts. (E) Cashews. (F) Almonds. (G) Walnuts. (H) Macadamia nuts. (I) Pecans. (J) Slivered almonds. (K) Sliced almonds. (L) Pine nuts. (M) Peanuts in the shell. (N) Pistachios in the shell.

in the identification of tree nuts and peanuts and to fill out a demographic sheet. The study was approved by the University of Texas Southwestern institutional review board, and verbal consent was obtained from all subjects. Demographic data collected included the subjects' sex, age, race, income level, and education. All subjects had to be at least 18 years of age and be able to read and speak English fluently. For this analysis, they were categorized into 2 groups: guardians of children with a peanut or tree nut allergy and guardians of children without a nut allergy (control subjects). Guardians in the control group were included if children did or did not have other food allergies, as long as they did not have peanut or tree nut allergies.

#### *Subjects at 2012 Meeting of the American Academy of Allergy, Asthma, and Immunology*

Adults attending the 2012 meeting of the American Academy of Allergy, Asthma, and Immunology (AAAAI) in Orlando, Florida were recruited to participate in the identification of tree nuts and peanuts and to complete a demographic sheet (online repository, Fig 1). Prior approval was obtained from the University of Texas Southwestern institutional review board, and verbal consent was obtained from all subjects. Demographic data collected included the subject's sex, age, and profession. All subjects had to be at least 18 years of age and able to read and speak English fluently.

#### *Data Analysis*

Statistical analysis was performed using SPSS 17.0 for Windows (SPSS Inc, Chicago, Illinois) and GraphPad Prism 5.04 for Windows (GraphPad, San Diego, California). Nonparametric statistical techniques were used for all statistical analyses. Descriptive analyses are presented using medians and interquartile ranges (IQR; 25th and 75th percentiles). The  $\chi^2$  analyses with exact *P* values were used for variable categorical tests because of the small cell frequencies and expected counts. Group comparisons were performed with Kruskal-Wallis and Mann-Whitney *U* tests. For multiple group comparisons, *P* values were corrected (*P<sub>C</sub>*) by multiplying the total number of groups compared (Bonferroni correction). Significance was defined by a *P* or *P<sub>C</sub>* value no higher than .05.

#### **Results**

One hundred sixty-eight subjects completed the questionnaire (Table 1). Of these subjects, 116 were guardians of children being seen at the Food Allergy Center; 66 of these were guardians of children with peanut or tree nut allergy and 50 were guardians of children without a peanut or tree nut allergy. Most of these subjects were women (88%) and 40 years or younger.

Fifty-two subjects were adults who attended the 2012 AAAAI meeting. Of these subjects, an equal number of women (52%) and men participated. Twenty-eight were allergists, 10 were academic allergists, and 18 were allergists working in private practice. Ten participants were allergy and immunology (A/I) fellows. The remaining subjects were primarily medical residents, physicians of other specialties, dietitians, food scientists, and a medical student. No nurse, nurse practitioner, or physician assistant participated in the study, although they were invited to participate.

Shelled and unshelled peanuts were identified correctly most often, followed by almonds (Table 2). Shelled hazelnuts and shelled Brazil nuts were least often identified correctly.

The median score in all subjects was 10.5 (IQR, 7–13) of a possible 14 (75% correct). AAAAI subjects performed significantly better than guardians of children with a peanut or tree nut allergy (13 [IQR, 11.75–14.0] vs 10 [IQR, 6.75–12.25], *P* < .001, *P<sub>C</sub>* = .003) and guardians of children without a peanut or tree nut allergy (13 vs 8.0 [IQR, 6.0–11.0], *P* < .001, *P<sub>C</sub>* = .003). Guardians of children with a peanut or tree nut allergy did not perform significantly better than guardians of children without a peanut or tree nut allergy (*P* = .09, *P<sub>C</sub>* = .27; Fig 2).

In all subjects at the Food Allergy Center, median total score differed significantly by education (*P* < .001). Subjects with a university or postgraduate degree performed significantly better than subjects with a commercial or technical degree (12 [IQR, 9.0–13.0] vs 9 [IQR, 6.75–12.0], *P* = .016, *P<sub>C</sub>* = .048) and those with a high school degree (12 vs 7 [IQR, 6.0–9.0], *P* < .001, *P<sub>C</sub>* = .003; Fig 3).

Further analysis was performed to determine whether the higher median score of AAAAI subjects compared with guardians of children seen at the Food Allergy Center was a reflection of the level of education or the expertise. Combined AAAAI subjects performed



**Table 1**  
Patient characteristics: demographics<sup>a</sup>

	AAAAI subjects <sup>b</sup> (n = 52)	GNACs (n = 66)	Control subjects <sup>c</sup> (n = 50)	P value
Sex				<.001
Men	25 (48.1)	6 (9.1)	8 (16.0)	
Women	27 (51.9)	60 (90.9)	42 (84.0)	
Distribution of age (y)				.001
18–30	6 (11.5)	20 (30.3)	14 (28.0)	
31–40	20 (38.5)	30 (45.5)	22 (44.0)	
41–50	10 (19.2)	14 (21.2)	8 (16.0)	
>50	15 (28.8)	1 (1.5)	5 (10.0)	
Missing data	1 (1.9)	1 (1.5)	1 (2.0)	
Education				<.001
Less than high school	0	1 (1.5)	1 (2.0)	
High school	0	20 (30.3)	23 (46.0)	
Commercial/technical diploma	0	16 (24.2)	10 (20.0)	
University/postgraduate	52 (100.0)	29 (43.9)	16 (32.0)	
Profession <sup>d</sup>				N/A
Academic allergist	10 (19.2)	N/A	N/A	
Private allergist	18 (34.6)			
A/I fellow	10 (19.2)			
Resident	2 (3.8)			
Dietitian	3 (5.8)			
Food scientist	3 (5.8)			
Other <sup>e</sup>	6 (11.5)			

Abbreviations: AAAAI, American Academy of Allergy, Asthma, and Immunology; A/I, allergy and immunology; GNACs, guardians of nut-allergic children; N/A, not available.

<sup>a</sup>Data are presented as number (percentage).

<sup>b</sup>Subjects at the 2012 AAAAI meeting.

<sup>c</sup>Guardians of children without nut allergy.

<sup>d</sup>Data for profession were not obtained for subjects at the Food Allergy Center at Children's Medical Center, Dallas.

<sup>e</sup>Includes project specialist (n = 1), pharmaceutical company–regulation affairs (n = 1), dermatologist (n = 1), unspecified scientist (n = 1), medical student (n = 1), and emergency physician (n = 1).

significantly better than guardians with a university or postgraduate degree (13 [IQR, 11.75–14.0] vs 12 [IQR, 9.0–13.0],  $P = .002$ ,  $P_C = .008$ ). Comparisons between AAAAI subjects and guardians with a university or postgraduate degree indicated that allergists who completed their training (combined academic and private) performed better than guardians with a university or postgraduate degree (13.5 [IQR, 12.0–14.0] vs 12 [IQR, 9.0–13.0],  $P = .001$ ,  $P_C = .004$ ). However, there was no significant difference in the median score of A/I fellows vs guardians with a university or

postgraduate degree (11 [IQR, 7.75–12.5] vs 12 [IQR, 9.0–13.0],  $P = .69$ ,  $P_C = 1.00$ ).

Allergists who completed their training performed better than A/I fellows (median total score, 13.5 [IQR, 12.0–14.0] vs 11 [IQR, 7.75–12.5],  $P = .02$ ,  $P_C = .08$ ). All 3 dietitians were able to correctly identify all tree nuts and peanuts, and 2 of 3 food scientists also had perfect scores.

## Discussion

As a whole, professionals attending an AAAAI national meeting were better able to identify peanuts and tree nuts than guardians of children seen in an academic food allergy center. Statistical significance remained regardless of the level of education. A/I fellows did not score as well as those who completed training. Although this finding was statistically significant, caution is warranted against overgeneralization because of the small number of individuals in the 2 groups sampled.

The question arises as to how to best educate food-allergic patients and their caregivers and which individual or individuals are best equipped to do so. Should the differentiation of specific tree nuts and peanuts be important at all? Peanut and tree nut-allergic individuals are often at risk of reacting to another nut or nut product secondary to cross-contamination, and cross-reactivity among individual tree nuts does exist. Therefore, it can be argued that individuals with tree nut allergies, regardless of the number of tree nuts the person is allergic to, should be instructed to completely avoid all tree nuts. Although this advice may be prudent for some individuals, households exist that have nut or nut products as a substantial part of their diet, and for those individuals, education in proper identification is important to keep the food-allergic family members safe.

For those individuals who wish to ingest particular nuts and avoid other nuts, it may be worthwhile to construct a nut identification box to assist with education in an allergist's office. The present data showed that allergists are often able to differentiate common tree nuts and peanuts. In their clinical practice, the authors often provide visual education in addition to educational avoidance handouts. For peanut- and tree nut-allergic individuals who wish to ingest particular tolerated nuts, the authors recommend that these individuals eat nuts they shell or that are obtained from a facility that does not process other kinds of nuts. For example, pecans, walnuts, almonds, and pistachios are commonly grown in the United States and may be obtained directly from domestic growers, whereas cashews and Brazil nuts are typically cultivated in tropical

**Table 2**  
Subjects correctly identifying various nuts

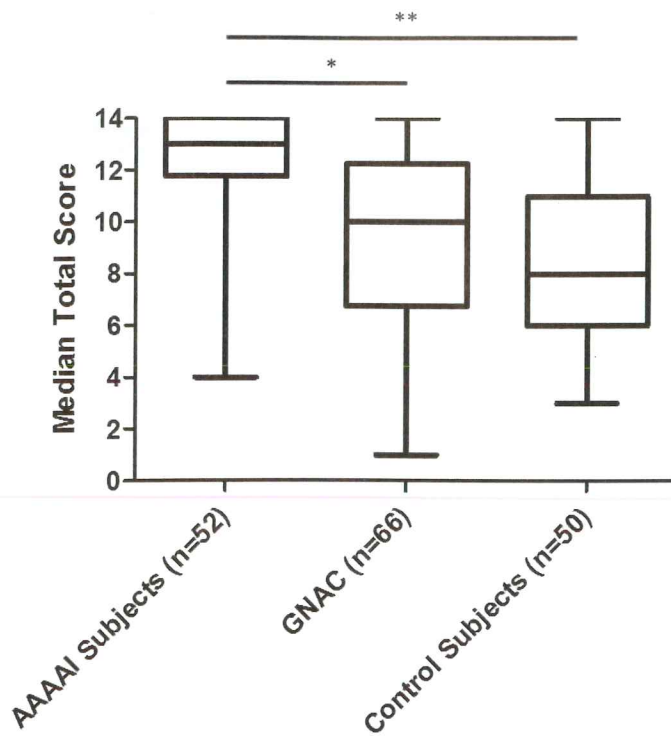
Type of nut	Total (n = 168)	AAAAI subjects <sup>a</sup> (n = 52)	GNACs (2) (n = 66)	Control subjects <sup>b</sup> (3) (n = 50)	P value	
					1 vs 2	1 vs 3
Peanuts in shell	95.8%	98.1%	95.5%	94.0%	.629	.358
Peanuts out of shell	92.3%	98.1%	89.4%	90.0%	.076	.109
Almonds	91.1%	94.2%	86.4%	94.0%	.224	.999
Pistachios in shell	87.5%	92.3%	84.8%	86.0%	.261	.353
Pecans	81.5%	82.7%	81.8%	80.0%	.999	.802
Cashews	81.0%	96.2%	72.7%	76.0%	.001	.004
Sliced almonds	77.4%	73.1%	80.3%	78.0%	.384	.648
Pistachios without shell	76.8%	98.1%	71.2%	62.0%	<.001	<.001
Walnuts	69.0%	96.2%	63.6%	48.0%	<.001	<.001
Slivered almonds	53.0%	86.5%	40.9%	34.0%	<.001	<.001
Pine nuts	51.8%	84.6%	42.4%	30.0%	<.001	<.001
Macadamia nuts	51.2%	75.0%	47.0%	32.0%	.003	<.001
Hazelnuts (filberts)	40.5%	75.0%	33.3%	14.0%	<.001	<.001
Brazil nuts	37.5%	67.3%	28.8%	18.0%	<.001	<.001

Abbreviations: AAAAI, American Academy of Allergy, Asthma, and Immunology; GNACs, guardians of nut-allergic children.

<sup>a</sup>Subjects at the 2012 AAAAI meeting.

<sup>b</sup>Guardians of children without nut allergy.



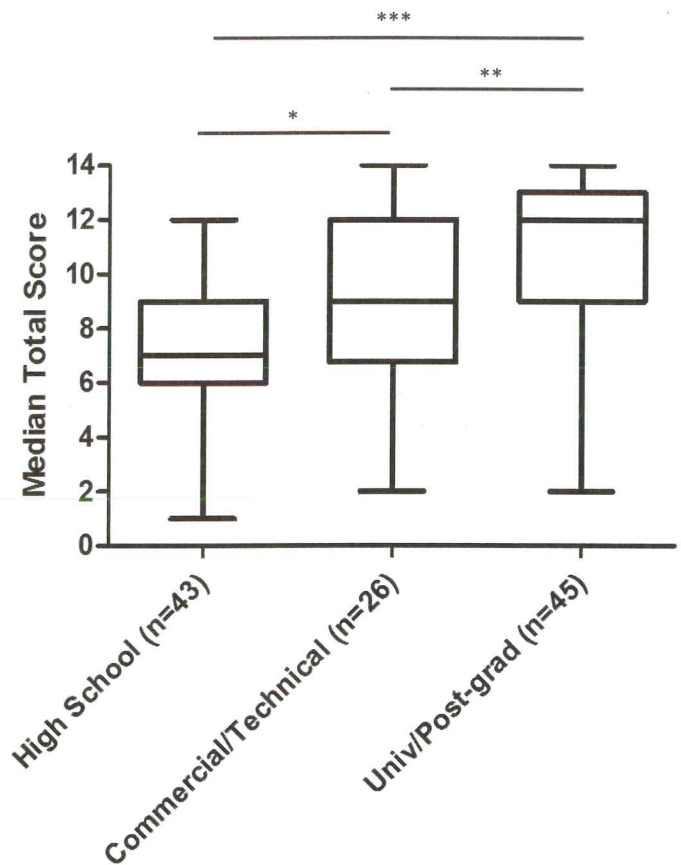


**Figure 2.** Comparison of median total score for subjects attending the 2012 meeting of the American Academy of Allergy, Asthma, and Immunology (AAAAI; median, 13.0; interquartile range, 11.75–14.0), guardians of nut-allergic children (GNAC; median, 10.0; interquartile range, 6.75–12.25), guardians of children without nut allergies (controls; median, 8.0; interquartile range, 6.0–11.0). \* $P < .001$  ( $P = .003$  with Bonferroni correction); \*\* $P < .001$  ( $P = .003$  with Bonferroni correction).

climates and are more often shipped into the United States. As a result, cashews and Brazil nuts are often processed in factories that process other nuts, and cross-contamination is of greater probability.

The present data is in agreement with those of Hostetler et al.<sup>7</sup> who reported that guardians of children with peanut or tree nut allergies were not better at nut identification than guardians of children without a peanut or tree nut allergy. The authors' initial hypothesis was that guardians of peanut- or tree nut-allergic children would perform better than controls based on an increased awareness of nuts in an attempt to avoid them. However, it is more likely that the practice of most of these families is to avoid peanuts and tree nuts completely; therefore, differentiation of nuts is not important to them. Regrettably, participants were not asked if their practice was to ingest particular nuts or completely avoid all nuts.

To the authors' knowledge, this is the first study to look at the ability of allergists to correctly identify peanuts and tree nuts and to compare this ability with that of an allergist's patient population. As with previous studies, similar limitations exist. Selection bias limits interpretability of the results obtained from professionals attending a national AAAAI meeting. Individuals with interest in food allergy were more likely to take the quiz; in addition, individuals more confident in their ability to perform well were more likely to take the quiz than individuals who feared doing poorly on the quiz. Limitations in the data collected in the Food Allergy Center include the very specific population being surveyed (patients in a food allergy center) at 1 independent site being seen by 1 physician. However, the data is in agreement with previously published data and reinforces the existing knowledge that adults are poorly capable of identifying nuts. In addition, as mentioned as a limitation by Hostetler et al.,<sup>7</sup> peanuts and tree nuts were not presented in the processed forms most commonly encountered (eg, in a muffin or other baked good).



**Figure 3.** Comparison of median total score by education among all subjects at the Food Allergy Center: high school education (median, 7.0; interquartile range, 6.0–9.0), commercial or technical diploma (median, 9.0; interquartile range, 6.75–12.0), and university or postgraduate degree (median, 12.0; interquartile range, 9.0–13.0). \* $P = .03$  ( $P = .09$  with Bonferroni correction); \*\* $P = .016$  ( $P = .048$  with Bonferroni correction); \*\*\* $P < .001$  ( $P = .003$  with Bonferroni correction).

Nut identification is difficult, and this study reinforces the notion that the general public and food-allergic individuals are poor differentiators of individual tree nut types. Successful allergen avoidance requires the cooperation and vigilance of a community of individuals, and education commonly starts in the physician's office. A nut identification box is easy to construct, simple to use, and may provide an effective tool for teaching peanut- and tree nut-allergic individuals and their families. In addition, allergists interacting with A/I fellows may consider nut identification as a simple training exercise in preparing future specialists.

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